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Book reviews

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Frankham R., Ballou J.D., Briscoe D.A.: A Primer of conservation genetics. Illustrated by Karina H. McInnes. 51 figures, 21 boxes, 20 tables, 16 examples, 105 unnumbered vignettes, xiii + 220 pp. Cambridge University Press, Cambridge, 2004. Hardcover £ 55.00, US $ 85.00. ISBN 0-521-83110-5; Softcover £ 19.99, US $ 31.99. ISBN 0-521-53827-0

In 2002, Frankham, Ballou and Briscoe, the same authors of the book reviewed here, published a large textbook on conservation genetics entitled *Introduction to conservation genetics*. The book's title was an understatement. Over the course of 640 pages, the authors covered most aspects of modern conservation genetics and illustrated the treated topics with many examples. This timely book received wide acclaim and became an instant classic. It is the textbook that most postgraduates and researchers in conservation genetics have read. But this large volume was almost too good, its coverage too wide, too many topics were dealt with in too much detail on too many pages. Undergraduate students or readers only interested in a short, but comprehensive "introduction" to the field of conservation genetics were sometimes frightened by the more than half thousand pages of the Frankham et al. (2002) book. This, I guess, is the reason why in 2004 Frankham et al. now present us with a *Primer to conservation genetics*, which is, essentially, a short version of their 2002 textbook. The question is whether they succeeded in capturing the essence of their previous opus in somewhat less than one-third the number of pages in the new book. It is a tricky thing to shorten something that has worked very well in a longer version.

First of all, why should we be interested in reading a book on conservation genetics, even if it is rather short? The authors state that the earlier notion that genetic issues are, at best, of second order importance for the conservation of species as opposed to environmental (e.g. habitat loss) or demographic (e.g. population size) issues has distinctly changed. The three fields now stand side by side. Personally, I would add to this that genetic methods offer the possibility to test many of the "dogmas" and underlying processes of conservation genetics. For instance, genetic studies have strongly changed our perception of gene flow. It could be demonstrated that long distance dispersal or gene flow, circumscribed as exchange of individuals and/or genes between populations or as colonisation events, is far more frequent than hitherto believed. For plants, genetic studies have proved that gene flow via pollen often occurs over large distances (e.g. White et al. 2002) and that even dispersal of seed or fruit regularly takes place at an frequency and at distances not previously thought possible (Godoy and Jordano 2001). This, of course, all has the potential to change the way we think about landscape fragmentation, isolation of populations, wild life corridors or green bridges. I felt that this ability of conservation genetics to investigate processes should have been stated more explicitly in the book.

In short, the following topics are covered by the *Primer to conservation genetics*, but many more are touched upon: loss of genetic diversity in small populations, inbreeding and loss of fitness, resolution of taxonomic

uncertainties (a field of direct interest to readers of Plant Systematics and Evolution), genetic management of threatened species and contributions of molecular genetics to the conservation of biodiversity. The first chapter starts off with some questions: Why conserve biodiversity? What threatens species? What causes extinctions? What is conservation genetics? The answers are given throughout the book; the first chapter only acts as an appetiser to the field of conservation genetics.

The second chapter deals with genetic diversity and provides a short introduction to population genetics (including the Hardy-Weinberg equilibrium as a central concept) and to molecular genetic methods such as isozymes or various PCR applications including microsatellites, which is currently the most widely used marker type in conservation genetics of animals, but less so in plants. This description of laboratory techniques is very short, and I doubt that readers entering the field will understand, e.g. the layout of Southern blotting. Throughout the book, much attention is given to mtDNA studies on animals, while cpDNA studies on plants are almost completely absent. I would also expect a *Primer of conservation genetics* to be stringent with the use of technical terms, but unfortunately this is not always the case. Examples are the authors' flipping between expected and observed heterozygosity (H_e and H_o) or between population size (N) and effective population size (N_e) throughout the book. The latter is a bit troublesome since the authors rightfully stress the difference between census population size and effective population size.

The third chapter provides an overview on the evolutionary genetics of natural populations. The authors state that conserving the evolutionary or adaptive potential (or the evoluability) of species is the major goal of conservation genetics, and they thus contribute many pages of the book to the delimitation of evolutionary significant units; a topic still energetically and controversially debated. This r also deals with gene flow and migration, recurrent topics of the book, adaptation, genetic load, quantitative genetics and heritability. What I particularly liked about the *Primer of conservation genetics* is the fact that the authors stress the importance of adaptive genetic variation, which cannot be measured with neutral molecular genetic markers in the laboratory, since there is no direct correlation between the two measures of genetic variation (Merilä and Crnokrak 2001, Reed and Frankham 2001). I also welcomed the authors' clear statement that adaptive genetic variation evaluated in quantitative genetic experiments, and not the neutral genetic variation from isozymes, AFLPs or microsatellites, is what conservation biology is most interested in.

What are the genetic consequences of small population size? Chapter 4 deals with genetic drift, loss of heterozygosity, inbreeding (F_{IS}), effective population size and fragmentation and also introduces population differentiation (measured as F_{ST}). It is clearly the intention of the book to introduce statistical measurements when appropriate in the context of a given topic and not to provide them in a more systematic manner. This makes the book highly readable, but, on the other hand, makes its use as a reference less straight forward, since most topics are scattered all over different parts of the book. In Chapter 4, I missed references to new methods of measuring bottlenecks (e.g. Luikart and Cornuet 1998), to overdominance, an important issue in quantitative genetics, or to the fact that measurements of gene flow based on F_{ST} (i.e. Nm) are merely historical and can largely deviate from current gene flow patterns. In addition, just to state that effective population size (N_e) can be measured from genetic data, but not to show how one goes about doing this is not what I expect from an introductory textbook. That selection is less effective in smaller populations than in larger populations due to the fact that the former are prone to random genetic drift is matter of debate and certainly depends on the strength of the selection coefficient s. Unfortunately, not all of the formulas given are correct (e.g. that for F_t on p. 63).

Chapter 5 treats extinctions and their relationship to genetic diversity, inbreeding depression (arguably *the* slightly overstressed theme of the book) and viability, ending with a brief outline of population viability analysis (PVA) and the famous extinction vortex. Here, the results of the review by Byers and Walter (1999), showing that purging of recessive deleterious alleles does not universally occur in natural plant populations, are dismissed.

Taxonomic uncertainties and the definition of management units are covered in Chapter 6, which also provides a short introduction to species evolution. For a population geneticist like me, thinking in units of different gene pools undergoing constant dynamics, many of the definitions given in this chapter seemed artificial (e.g. what is a subspecies?) and, for instance, the delimitation of evolutionary significant units (see above) based on neutral genetic variation was rather doubtful to me (also see Bachmann 1998). On the one hand, I could well support the authors' statement that it is unfortunate that chromosomal studies are out of fashion, even though they could potentially solve many problems in an elegant and easy way. On the other, I was surprised that phylogeography was not even mentioned in this chapter.

Chapter 7 starts with a list of the most important genetic issues in endangered species in the wild (p. 124), covering topics such as increasing population size, management of fragmented populations (corridors!), increasing gene flow, re-establishment of extinct populations, the design of reserves or hybridisation. Here, the authors spend a little bit more effort on plant examples with respect to selfing, clonal and polyploid species. The whole of Chapter 8 deals with captive breeding and reintroduction. This is a big theme in American and Australian conservation biology (Hedrick 2001) but much less so in European countries, where conservation geneticists are mainly concerned with natural populations. I found this chapter of about 20 pages repetitive, since many of the examples provided are also given in other chapters of the book. Given the shortness of the book, it is surprising that some paragraphs are fairly redundant (e.g. the Golden Lion Tamarin case study). Plant biologists will be disappointed anyway, because the ex situ conservation of plants is dealt with in a single short paragraph (p. 155).

Chapter 9 first mentions the utility of genetic methods in forensics (e.g. detecting the sale of meat from protected whales) and then shows how genetics can be used to understand species biology (mainly a compilation of case studies). I was rather disappointed by this chapter and felt that a major discrepancy between European and American or Australian conservation genetics becomes clear here. European researchers tend to incorporate genetic investigations within larger conservation projects also dealing with a species' ecology, its population biology or recent population history using both descriptive and experimental approaches. Particularly, European researchers put more effort into the circumscription of suitable habitat, making use of vegetation or landscape ecological data. I sadly missed a more direct integration of conservation genetics with, e.g. ecological studies. Unfortunately, such a fruitful marriage of conservation genetics with other scientific fields is not achieved in this final chapter of the *Primer of conservation genetics*. Otherwise, this last chapter (again) deals with topics such as coalescence, gene flow, bottlenecks, breeding systems and parentage analysis. A glossary follows, providing explanations that are sometimes difficult to understand. An example: "Dominance: Deviation of heterozygote phenotype from the mean of homozygotes at a locus, say in the direction of the wild-type homozygote compared to the mutant homozygote" (p. 196). The book ends with an index of nine pages.

Formally, the book is structured in an appealing way: there are vignettes showing the animals and plants mentioned in the text, tables and figures, worked examples, boxes explaining certain topics in more detail and grey boxes besides the text highlighting the main messages. What is rather unusual is that

no references are given in the text. At the end of each chapter, there are just suggestions for further reading, and, at the end of the book, the references of the sources used are given, but without any direct connection to the examples of the text. I did not like this approach. Students should learn to critically cross-check information, and, in general, readers should have the possibility to go into more detail with a particular study. Similarly, throughout the book, no statistical tests are given. Again, I think that, at least in tables and figures, the types of tests performed and their significance levels should be given in order to accustom students, who are potentially the target audience of the *Primer of conservation genetics*, to the frequent use of statistical testing.

Now, that I have quite heavily criticised the new book of Frankham et al., it may come as a surprise when I say that I liked the book a lot. I read it within a single week, showing that it is written in an easy-to-read style, gives a good overview (or refresher for the older ones of us) and provides interesting examples. I felt that the book could also serve as a textbook for a graduate course on population genetics. In fact, the *Primer of conservation genetics* covers a lot of basic population or ecological genetics including molecular techniques and quantitative genetics, touches upon fields such as phylogeography or speciation, and, as a whole, treats a subject that students are generally interested in, at least more so than in theoretical population genetics. A comparison of the contents of the *Primer to conservation genetics* with those of two recent books on ecological genetics shows that the former has a wide, though necessarily superficial, coverage of topics. For instance, the ecological genetics textbook of Lowe et al. (2004) does not cover quantitative genetics at all, while the volume of Conner and Hartl (2004) treats quantitative genetics at length, but dismisses other important topics such as phylogeography or speciation.

Finally, I come back to the question posed that the beginning of this review: Have the authors succeeded in providing a brief, but concise version of their already classical textbook on conservation genetics from 2002? The answer is yes and no. I enjoyed reading the *Primer of conservation genetics*, and I would definitely recommend it as a first introduction to the field of conservation genetics. A nice summary of the content of the book is given by the take-home messages listed on pages xi and xii. However, I felt that the reasoning was much stronger, clearer and better illustrated in the longer version of the book. For those interested in conservation genetics per se, I would thus still recommend reading the original (Frankham et al. 2002). I end using the authors' words (p. 193): "[I] found this book informative, thought provoking and interesting and […] it will assist in [my] future conservation activities. The earth's biodiversity is being lost at a frightening rate, so we must act now to conserve our life support system. Extinction is for ever!"

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Kubitzki K. (ed.): Flowering plants. Dicotyledons. Celastrales, Oxalidales, Rosales, Cornales, Ericales. (The Families and Genera of Vascular Plants, vol. 6). 137 figs., xi + 489 pp. Springer, Berlin Heidelberg, 2004. Hardcover € 212.93, £ 153.00, US $ 225.00. ISBN 3-540-06512-1.

Given the important changes to the classification since the start of this volume series, it has been a challenge for editors to accommodate information for most flowering plant families in a reasonably updated account. The continuation of this series on a regular basis is evidence for the commitment of the editor(s) and contributing authors. This is the most updated, comprehensive, and complete work embracing the seed plants and it is of great interest to scholars and students alike.

This is the third volume in the series since the transition to the new molecular classification system. The book follows the arrangement of taxa in AP6 II (2003), although it does not follow the higher circumscription of clades: Celastrales, Oxalidales, and Rosales belong to eurosids I, and Cornales and Ericales to asterids.

Fifty-one different contributions to this volume mean that there is a variety of approaches that are homogenized by the requirements of a strict style. The volume contains an extensive and highly informative introduction to the major orders by K. Kubitzki, complemented by a major reference list. This is very useful in understanding the setup of families in the renewed classification. Regretfully only one general phylogenetic tree is provided (for Ericales), while it would have been helpful to have this for the other orders as well. The alphabetical treatment of families is user-friendly, as well as the alphabetical order of genera, much better than the complicated arrangement in Engler and Prantl.

The volume gives an excellent account of the current knowledge of different taxa, although it is clear that much more studies are needed, especially on the morphology to supplement the molecular data. The amount of illustrations is variable, depending on the contribution and is often taken from older nineteenth century volumes (the only exception being the contribution on Hydrostachyaceae with original illustrations). The setup of the account is highly informative, discussing different attributes of the family, followed by a distinctive key to the genera, both based on vegetative and floral characters. I find the contributions extremely useful for my personal research, as a pool of characters or for comparative purposes.

The series is timely, but can become quickly outdated by the rapid shuffle of phylogenetic relationships, as can be seen by comparing APG (1998) with APG II (2003). However, the updated accounts of genera have much value as sources of information, comparable to previous standard reference works. Another valuable aspect of the book is that it is also an excellent synopsis of different publications that would remain scattered otherwise.

The shift in position of major taxa on the basis of molecular data leads to a number of difficulties, as several major groups do not share many or any obvious morphological characters. One important consequence of using morphological characters is that evolution of those characters has gone far through